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The Role of Environmental Assessment in Promoting Sustainable Development: Three Views

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THE ROLE OF ENVIRONMENTAL ASSESSMENT IN PROMOTING SUSTAINABLE DEVELOPMENT: THREE VIEWS

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DECISION-MAKING FOR SUSTAINABLE DEVELOPMENT: POTENTIAL IN SELECTED APPROACHES TO ENVIRONMENTAL ASSESSMENT AND MANAGEMENT

by Julia E. Gardner

ABSTRACT

Nine approaches to decision-making for environmental assessment, planning and management are reviewed to determine their support for principles of sustainable development. They range from an ecological approach to environmental impact assessment to adaptive environmental assessment and management. Examples of the eight principles distilled from the literature on sustainable development are the substantive principles of meeting human needs and maintaining ecological integrity, and the process principles of adaptiveness and integration. The more comprehensive approaches are found to support a broader range of principles, although at a high level of generality. The narrower approaches may play important complementary roles in their more rigorous support for individual principles. While tensions confront simultaneous adherence to all eight principles, full support for sustainable development depends on such adherence. The coordinated application of the nine approaches would well support sustainable development in theory, but important substantive principles would remain neglected. Non-technocratic approaches such as bioregionalism and co-management hold an unexplored potential for filling this substantive gap.

INTRODUCTION

A number of recent reports, including those of the World Commission on Environment and Development (WCED 1987) and Canada's National Task Force on Environment and Economy (1987), have called for the strengthening of tools and techniques for sustainable development and for a more integrated process of environment and development decision-making. These recommendations motivate this review of the role and contribution of environmental assessment and related processes of planning and management in implementing sustainable development. While the context for the review is Canadian, the questions addressed are common to the challenges posed by the sustainable development imperative anywhere, namely:

- What does the concept of sustainable development imply for approaches to decision-making in environmental assessment, planning and management?

- How well do selected approaches to decision-making currently support the principles of sustainable development?

- How can environmental assessment, planning and management better support sustainable development?

Nine approaches designed to improve decision-making for resource management are examined, ranging from environmental impact assessment to integrated resource management. Before introducing them, the context for the review will be set by elaborating upon the concept of sustainable development.

DEFINING SUSTAINABLE DEVELOPMENT

The concept of sustainable development probably was first interpreted as a strategic approach to integrating conservation and development by the International Union for the Conservation of Nature and Natural Resources (IUCN) in the *World Conservation Strategy* (1980). The Strategy says that sustainable development

...must take account of social and ecological factors, as well as economic ones; of the living and non-living resource base; and of the long term as well as the short term advantages and disadvantages of alternative actions.

The WCED approached the concept more directly in its report, which is referred to as the "Brundtland Report"(1987):

- sustainable development is . . . development that meets the needs of the present without compromising the ability of future generations to meet their own needs (p.43)

As the WCED was working on its report, the Canadian National Task Force on Environment and Economy, comprised of senior officials from industry, non-government organisations, and government, was producing a national report to the Canadian Council of Resource and Environment Ministers. It adopted a similar interpretation of the term:

- sustainable development is . . . development that ensures that the utilization of resources and the environment today does not damage prospects for their use by future generations (National Task Force 1987).

The Task Force report harkens back to the World Conservation Strategy in calling for conservation strategies as guides for sustainable development for each of the provinces. Provinces that now have either draft or completed conservation strategies include Prince Edward Island, Quebec, Ontario, Alberta and British Columbia. (See Canadian Society of Environmental Biologists 1987, for a synopsis of progress to date).

Through media coverage and academic and interest group attention, the WCED Report and the Task Force Report have begun to popularize the concept of sustainable development in Canada. Yet the themes presented in these reports had undergone considerable analysis and review prior to and parallel to these strategic initiatives. In North America, conservation-oriented notions of resource management such as best use, wise use and sustained yield go back to the turn of the century. Academics and others interested in social change and sustainability developed theoretical precursors to sustainable development, including appropriate technology (Schumacher 1973) and the ecological society (Bookchin 1980). Academic work on sustainability contemporary to the recent government initiatives includes Brown (1981), Clark and Munn (1986) and Jacobs and Munro (1987).

Various conferences have proven pivotal in the evolution of sustainable development thinking. From the United Nations Conference on the Human Environment in Stockholm in 1972 emerged the idea of ecodevelopment. This concept, since addressed by academics Repetto (1985), Riddell (1981) and Dasmann (1984), is closely related to that of sustainable development, as:

...an approach to development aimed at harmonizing social and economic objectives with ecologically sound management, in a spirit of solidarity with future generations; based on the principle of self-reliance, satisfaction of basic needs, a new symbiosis of man and earth; another kind of qualitative growth, not zero growth, not negative growth (Sachs 1978).

Almost fifteen years after Stockholm, at the first World Conservation Strategy Conference in 1986, international interests again emphasised the need for continued development in tune with environmental conservation, decrying the tendency of developed countries to focus on global conservation measures in isolation from the problems of underdevelopment. Lately, the interconnections of an unstable global economy and trans-national environmental degradation have had obvious enough effects to force countries at all stages of development to look at both sides of the environment-development dilemma.

Both internationally and within Canada, themes related to sustainable development have been supported and developed by government bureaucracies. Ecodevelopment, for example, has been promoted by the United Nations Environment Program, the Canadian International Development Agency, and Maurice Strong, a respected policy advisor to the Canadian government. Similarly, the conserver society, a theme also supported by Dasmann and Repetto, was documented by the Science Council of Canada for application in this country in 1977.

At a more fundamental level, the source of the heightened awareness of the global problems that led to the high profile reports of 1987 is not obvious. It may be found amongst environmentally enlightened bureaucrats, educated in ecology and economics; or it may arise from the synergy of social movements for peace and the environment and against poverty, which form a vanguard for social and political change. In either case, it is the magnitude of support for the integration of environment and development, particularly at political levels, which distinguishes the present incarnation of the "ecodevelopment/ sustainable development" theme. In unprecedented numbers, citizens and decision-makers at all levels are coming to realize that we cannot continue to do business as usual. A new sense of commitment and responsibility characterizes the current active and massive dialogue on sustainable development.

Through this dialogue the scope of the potential for widely varying interpretations, debate, and frustration surrounding the concept of sustainable development has become obvious.

Headlines in the Toronto *Globe and Mail*, which is sold as "Canada's national paper", present sustainable development as "limitless growth" and "good business" (Michael Keating 1988), while the WCED allows that it can be a kind of development, whether economic or not, that "aims to promote harmony among human beings, and between humanity and nature" (1987 p.65). The present work enters the dialogue with the intention of clarifying questions as much as answers, helping to move the discussion towards a workable consensus, and reinforcing higher level commitment to sustainable development.

PRINCIPLES FOR SUSTAINABLE DEVELOPMENT

From the literature referred to above, I have distilled eight main principles for sustainable development. Papers from the Conference on "Conservation and Development: Implementing the World Conservation Strategy" (Jacobs and Munro 1987) have also contributed to the delineation of the principles, notably those by Galtung; Halle and Furtado; Jacobs, Gardner and Munro; Khosla; Spitz; Sunkel; Walker; and Warford.

In the analysis to follow the eight principles are applied as premises that approaches to decision-making for resource management have to support in order to steer us towards sustainable development. The principles are divided into two categories: substantive and process-oriented. Substantive principles relate to values; they describe the ends of decision-making. These are the fundamental, global goals which are addressed by approaches to assessment, planning and management for sustainable development. Process principles describe the means of decision-making: the structures, contexts and processes that are necessary to the pursuit of sustainable development.

This process and substance division of principles is useful for present purposes but it is not definitive. There is considerable overlap between the categories which, at a later stage of conceptualization, could be carefully mapped. Neither type of principle should be regarded as pre-eminent. The successful pursuit of sustainable development relies on a mixture of substantive and process-oriented considerations.

The first of the substantive principles is the *satisfaction of human needs*. This principle embodies the precept that the sustainability of conservation achievements depends upon the sustenance of the human culture that determines the way resources are used, and in the developing countries at least, this depends in turn upon development (Halle 1985). Development is necessary for the satisfaction of needs related to energy, water, food, jobs and sanitation (WCED 1987 pp. 54-55); and generally for increased human wealth and well-being. But because needs can only be met in the long term by conserving and enhancing the resource base, economic growth will have to be less material- and energy-intensive and more equitable in its impact, more so in the developed countries (WCED 1987 pp.52-60). Qualitative forms of development will be at least as important as economic growth. Development as change will be appreciated for its role in maintaining the resiliency of organizations and their continued ability to meet human needs. Of the major documents on sustainable development cited above, only the Canadian Task Force report emphasises economic growth over other forms of development.

The second substantive principle, *the maintenance of ecological integrity*, encompasses the three goals of the World Conservation Strategy related to living resource conservation: maintaining essential ecological processes and life support systems; preserving genetic diversity; and ensuring the sustainable utilization of species and ecosystems (IUCN 1980). Adherence to this

principle depends on staying within the limits of ecological carrying capacity by promoting ecologically realistic consumption standards and ensuring that ecological priorities are present at decision centres (National Task Force 1987 p.6). Given that a large portion of the world's ecosystems are now degraded, attention must be paid to their restoration as well as preservation and maintenance.

The third substantive principle was prominent at the World Conservation Strategy Conference in 1986 - *the achievement of equity and social justice.* The priority on establishing equity in this context is based on the observation that "Historical patterns of resource use repeatedly demonstrate the importance of commonality of interest and egalitarianism in environmentally prudent behavior" (Jacobs et al. 1987 p.21). Achieving equity at the international scale will require the revival of economic growth in developing countries (WCED 1987 pp.49-52). Equity between generations depends on decision-making that takes into account inter-generational consequences of actions on living standards - a major theme in the sustainable development literature from Repetto (1985) to the National Task Force (1987). Equitable access to resources and allocation of costs and benefits also depends on the avoidance of ecological limits, where inequities increase, and a fair distribution of power in decision-making.

The fourth substantive principle is *provision for social self-determination* and cultural diversity. While this principle dovetails with that of social justice, it is distinguished by its emphasis on self-reliance, individual development and fulfilment outside acquisitive materialism, and endogenous, culturally appropriate forms of development. Although government and planning intervention are still necessary for the regulation of the private and corporate sectors, the emphasis of social self-determination is on local or community initiative and control in decision-making. Experience has shown that central control cannot effectively tap the managerial capabilities of local communities or the potential for citizen initiative in promoting ecologically sound behaviour, especially on a voluntary basis.

The first process-oriented principle requires that approaches to sustainable development be *goal-seeking*. This means that approaches seek pre-identified goals in a normative, pro-active way, and also seek to identify new goals and policies or priorities that are consistent with principles of sustainability. Goal-seeking will thus ensure the pursuit of the substantive principles and their refinement and tailoring to specific situations. Motivation for action is taken beyond reaction, anticipation or procedure to be positive, value-oriented, initiating, innovative, and alternative generating. Decisions are based on the consideration of a wide range of options and a convergence of individual and societal interests.

The second process principle is that the analytical aspect of approaches to sustainable development must be *relational or systems-oriented*. The systems orientation draws attention to key points of entry into a system, dynamics and linkages within and between systems, and the spatial and temporal context of decision-making. Awareness of interconnections between human and biophysical systems, or economics and environment, is integral to the sustainable development theme. Attention to spatial and temporal scale leads to a mix of solutions appropriate to the decision-making arena of concern, with full consideration of implications for other arenas, whether larger or smaller, sooner or later.

The third process principle maintains that strategies for sustainable development must be *adaptive*. Adaptive approaches manage risk through anticipation and prevention while seeking balance in human and natural systems through monitoring and self-regulation. Feedback and

self-reflection facilitate an approach to management that is dynamic, responsive, evolutionary and iterative, facilitating experimentation and learning. Such an approach permits the seeking, testing and redesigning of goals, and helps managers respond to surprise and discontinuous change in ways that promote sustainability. Resilience in the face of unexpected events also depends upon maintaining diversity or variety and conserving multiple options, in human and biophysical systems.

The final process principle requires that organizational approaches to sustainable development be *interactive*. An interactive design for organization promotes trans-disciplinary collaboration amongst experts for the synthesis of strategies for management, and integration within and between management systems or sectors for strategy implementation. Participatory and consultative organizational processes provide for the melding of socio-cultural, technical and institutional interests and objectives in the goal-seeking process, so that decision-making fully takes into account both environmental and economic concerns. The National Task Force (1987 p. 6) refers to "a shared partnership of governments, industry, non-government organizations and the general public" which will "guide us through an integrated approach to environment and economy".

Each of these principles is a prerequisite to sustainable development. While some may conflict with one another in current practice, in the terms of sustainable development they are profoundly interdependent and they cannot be ordered by priority or selected among - as Repetto (1985 p.15) states, "The elements of a program to promote sustainable development support each other and are attractive both environmentally and economically".

The eight principles are purposefully selected and defined here in a broad-brush manner, without addressing specific technological, economic or political prescriptions. More detailed treatment of the themes of sustainable development has been undertaken by the commissions and authors from whose work these principles have been distilled, and will be undertaken by on-the-ground experiments which are already underway. The level of generality maintained here suits the purpose of reviewing approaches to environmental assessment which are also designed at a level of maximum transferability in application. Assuming the guidelines ensconsed in these principles and approaches are sound, any detailed application that is consistent with them will promote progress towards sustainable development.

REVIEW OF APPROACHES TO ENVIRONMENTAL ASSESSMENT, PLANNING, AND MANAGEMENT IN TERMS OF THE PRINCIPLES OF SUSTAINABLE DEVELOPMENT

Nine approaches to decision-making for resource or environmental management that have evolved over the past decade or so were selected for review in terms of their support for sustainable development. All nine immediately appear to be seeking an approach to decision-making that at least partially reflects the principles of sustainable development, and most are critical of longer-standing, conventional approaches. Some are designed in response to perceived inadequacies in others, evolving from one another in an iterative process to fill gaps. Three general types of approach are included. Progressing from the narrowest to the broadest in application, they are:

- *environmental impact assessment*, which focuses on the prediction and assessment of environmental impacts and the mitigation of damage, usually on a project-specific basis;

• *environmental assessment*, which attempts to understand interacting elements and processes of the environment including human activities for decision-making purposes, and is undertaken at various stages of management and planning; and

• *resource or environmental management and planning*, which aims to minimize environmental damage and optimize resource use through the direction and control of human activities.

The nine approaches are listed here in order from narrow to broad, progressing through the spectrum from environmental impact assessment to environmental planning and management:

Ecological framework for environmental impact assessment

Impact hypothesis statements

Environmental impact assessment audits

Cumulative effects assessment

Bargaining in impact assessment, monitoring and management

Adaptive environmental assessment and management

Sustainable redevelopment

Impact zoning

Integrated resource management

A description of the approaches is included in their review, below.

Because the approaches are designed to fill a range of applications, variations in their support for sustainable development are to be expected - the broader the intended application of the framework, the more likely it is to reflect a wide range of principles. Nevertheless, it is useful to look at the approaches together in order to make the linkages between them and their relative roles more explicit.

The eight principles identified earlier are general, descriptive guidelines which prescribe a certain character for decision-making. They could apply to a wide range of approaches, and are not ingredients for the definition of a particular approach - the approaches reviewed here were certainly not designed with these specific principles in mind. The purpose of the present analysis is, therefore, not to judge the approaches, but to find out to what extent they seem to support principles for sustainable development superimposed upon them, i.e. to investigate ways in which authors have been heading towards approaches that integrate these principles, whether by design or by chance. The key question here is, What is the role of the various approaches in contributing to the new perspective?

In addition to assessing the roles of the approaches, this review should contribute to an

enhanced understanding of the concept of sustainable development. An analogy can be drawn between this search for understanding and the parable of the blind men and the elephant. The eight principles represent a first approximation of the animal called sustainable development, and the nine approaches represent the blind men, here assumed to be describing a portion of this new animal. In this section of the report the nine approaches are briefly characterized and their approximations of the sustainable development animal are summarized. In the closing section the contribution of the combined wisdom of the nine to the pursuit and understanding of sustainable development is assessed, and a need is identified for an additional, non-technocratic perspective to complete the picture.

Ecological framework for environmental impact assessment

This framework encompasses Beanlands and Duinker's (1983) requirements for an improved approach to environmental impact assessment (EIA), based on their review of Canadian experience in EIA (see also Beanlands 1985 and Duinker 1985). Primarily, these authors urge adherence to basic ecological concepts wherever possible, and a focus on "valued ecosystem components" - the environmental attributes considered to be important in project decisions. Their requirements overall are intended to allow maximum flexibility in applying a rigorous scientific approach to EIA.

Of the nine approaches, this one has the narrowest intended breadth of application; it is accordingly less likely to promote a wide range of the principles for sustainable development. Because its application is confined to the evaluation of individual project proposals, it cannot take a pro-active stance. While societal priorities come into the important reference point of valued ecosystem components, consideration of human systems is secondary to the focus on biophysical science and ecology. The objective is to anticipate and prevent environmental impacts, with less concern for resilience and responsiveness.

Little attention is paid to the substantive principles by this framework: in keeping with the analytical, scientific perspective, normative judgements are avoided. Even ecological concepts, while central to the approach, are not expected to *drive* decision-making but to *compete* with non-ecological values. The utility of the ecological framework for EIA lies in its pursuit of predictive rigour, when applied in conjunction with more pro-active and integrated approaches.

Impact hypothesis statements

Environmental and Social Systems Analysis (a Vancouver-based consulting firm) has developed an assessment tool called an impact hypothesis, which is a statement describing the major biophysical and social processes that connect a development activity with its potential environmental effects (Sonntag 1987; LGL Limited et al. 1984). This approach again focuses on effects on valued ecosystem components, drawing directly from the work of Beanlands and Duinker. The advantages of the impact hypothesis approach are that it explicitly states the mechanism behind predictions of impact in impact statements, and it provides a common framework which facilitates comparison among projects. Although the approach essentially remains oriented to the single project EIA, its stronger emphasis on adaptive strategies and relational rather than predictive analysis gives it a closer adherence to the process-oriented principles for sustainable development. If the impact hypothesis approach is used within more comprehensive frameworks, it holds considerable potential for contributing to sustainable development, because of its recognition of the centrality of linkages between development

activities and the biophysical environment.

Environmental impact assessment audits

Experience with this approach is well summarized in Naivasha Consultants' (Munro et al. 1986) "state-of-the-art review and evaluation of environmental impact assessment audits". Audits of EIAs can provide the factual basis for the examination and evaluation of the accuracy and utility of environmental impact forecasts, leading to increased effectiveness and efficiency of EIAs at the technical and administrative levels. They also have the potential to take the frame of reference for EIA beyond its traditional confines to meet a wider range of principles for sustainable development. While maintaining the bias towards improving the prediction of impacts, the audit can extend the role of EIA into the policy or goal-seeking sphere and enhance EIA as a learning experience. Munro et al. (1986) emphasize the importance of interactive organizational arrangements and capabilities in binding EIA to comprehensive planning. Still, substantive principles are not directly supported, even though a policy connection is made.

Cumulative effects assessment

The review of cumulative effects assessment (CEA) here is based on Sonntag et al. (1986), Peterson et al. (1986) and on a joint report by the Canadian Environmental Assessment Research Council and the U.S. National Research Council (CEARC and USNRC 1986). Like impact assessment audits, CEA is a direct response to perceived deficiencies in conventional approaches to EIA. While maintaining an impact orientation, CEA should take EIA beyond the project level to program and policy level concerns, broaden its spatial and temporal scope, and be more comprehensive and interdisciplinary, as well as better integrated with impact monitoring and management systems. In making this transition, the approach opens itself to a larger selection of principles for sustainable development, including substantive ones. For instance, this approach is the first to openly address "quality of life" concerns and some normative aspects of organization for decision-making.

On the negative side, by calling for "massive centralized control" (Peterson et al. 1986 p.31) in response to the need for integration of complex institutional arrangements involved in the control of cumulative effects, the approach effectively precludes opportunities for locally-initiated decision-making. The CEARC/USNRC (1986) review of cumulative effects assessment identifies a similar paradox: CEA may not be able to express conclusions in terms that are relevant to different parts of society that have different environmental values because of its tendency to deal with a net effect, a single end result impacting on a single societal entity. Nevertheless, the innovations of this approach stand out for their promotion of principles that are skirted by most environmental assessment frameworks and ignored by its EIA predecessors. For example, it forces the analyst to be creative, it incorporates advances in goals-based planning, and it confronts the possibility of structural changes in physical, social and ecological systems.

Bargaining in impact assessment, monitoring and management

This approach moves beyond EIA to describe how impact assessment, monitoring and management (IAMM) can all be enhanced through improved processes of interaction between people in resolving issues and seeking agreement. Central themes are bargaining, mediation and negotiation in the resolution of conflicts involving scientific and social issues, usually in a project-specific context. Dorcey (1986) maintains that effective bargaining relies on appropriate

information, representation, interaction skills, and structures (see also Dorcey and Martin 1985). Susskind et al. (1987) have provided a set of steps for successful negotiation and have identified obstacles to success which, if taken into account, should produce decisions that are "fairer, more efficient, wiser, and more durable" (p.127).

A focus on bargaining and negotiation in IAMM holds promise for supporting sustainable development through the pursuit of equitable decision-making practices, and by contributing practical directions for adhering more closely to principles of interaction, including integration and consultation in management. The approach also serves to remind us that conflicts are inherent to the pursuit of sustainable development priorities, and their effects cannot be ignored.

Adaptive environmental assessment and management

This approach differs from EIA not only in its much broader application but in its bias towards coping with uncertainty rather than improving predictability. The aim of adaptive environmental assessment and management (AEAM) is to integrate environmental with economic and social understanding throughout the environmental policy and design process, responding to the effects of management as it proceeds. Best known through the work of C.S. Holling and his colleagues at the International Institute of Applied Systems Analysis (IIASA) in Austria and at the University of British Columbia (Holling 1978; IIASA 1979), the approach is based in the techniques of computer system modelling and systems analysis. (See also ESSA 1982; Holling 1986; Jones and Greig 1985; and Regier 1985). The intellectual links between the authors of AEAM and those of cumulative effects assessment are implicit in the emphases on certain principles that the approaches hold in common - in fact, CEA expressly uses AEAM approaches.

The AEAM approach supports all of the process-oriented principles for sustainable development to a large extent. Only the interactive criterion is compromised, by constraints on local involvement posed by the sophistication of the analytical approach. A major focus of AEAM is on adaptive strategies, in which learning is as important as problem solving, resilience is a higher priority than prevention, and objectives and designs are formulated that can benefit from the unexpected. But the notion of adaptation goes beyond strategy to prescribe integrative forms of organization, approaches to analysis that place priority on relations above data, and an ideology that condones the purposeful influencing of policy by AEAM processes. This latter priority permits the approach to support substantive principles through a prescriptive orientation. However, some substantive principles still are not explicitly supported, notably those related to equity and social justice.

Sustainable redevelopment

This term, coined by Regier and Baskerville (1986), means the ecological rehabilitation of degraded natural environments and renewable resources toward sustainability. In contrast to AEAM, sustainable redevelopment adheres less strongly to the process-oriented principles but promotes the substantive principles more consistently than any of the other approaches. Analysis of the approach here may be somewhat tautological because of its conceptual proximity to sustainable development, but it is worth looking at for its demonstration of the way the very language of sustainable development can be incorporated into practical approaches to decision-making for environmental planning and management. For example, Regier and Baskerville remind us that local control is a practical as well as an ethical imperative if we are to "act locally" while "thinking globally", and that a long term perspective on development is

essential.

The fact that sustainable redevelopment is somewhat less ambitious in its schemas for analysis and strategy than some of the more comprehensive frameworks may reflect its unique recognition of the trauma and the tension involved in ensuring the convergence of local management interventions with plans for global sustainability. Some sophistication of analysis, of the sort demonstrated by AEAM techniques, may have to be sacrificed so that "a well-functioning independent soft set of local allocative methods" is not destructively overridden (Regier and Baskerville 1986 p.99).

Impact zoning

This approach provides a framework to guide development decision-making that is based on the ecologically-derived concept of regional carrying capacity. Developed by Rees (1981) and Rees and Davis (1978), impact zoning would require the locating of development or projects in areas that had been predetermined through an explicit regional planning process as suitable for the use proposed on the grounds of biophysical capability.

This approach returns us to the emphasis on broader scale integration of management across administrative sectors at the regional level that is characteristic of the process-oriented approaches such as bargaining in IAMM. The tension between central control and local initiative mentioned above is resolved through the conceptualization of impact zoning as a positive framework for regulation that is supplemented by creative negotiation and performance monitoring. Yet the approach does not clarify how zoning can be both firm enough to play a fail safe role in ecosystem maintenance and flexible enough to "respond to changing values, perceptions, knowledge and economic realities, as community development proceeds" (Rees 1981 p.32).

The impact zoning approach is notable for its consistent and explicit adherence to the substantive principle of maintaining ecological integrity. Where other approaches waver in their commitment to ecological constraints on development as a "bottom line" for decision-making, impact zoning is founded on a closed system definition of carrying capacity and the awareness of humankind's dependency on the biological productivity of ecosystem resources. Implied compromises in the freedom of locally-initiated decision-making may be ethically justified by the support this approach offers for the principle of equity *between generations* - a principle that is not explicit in the other approaches.

Integrated resource management

This is a strategic, interactive approach to management that attempts to bring a wider range of needs and values into the decision-making process and to deal with planning, assessment and implementation in concert. It also addresses some of the central themes of approaches discussed above, such as uncertainty and cumulative effects. Literature consulted on this approach was by Lang (1986), Sadler (1986), Cornford et al. (1985) and others.

Approaches to integrated resource management (IRM) focus, as the name indicates, on the principles of integration for all aspects of resource assessment, planning and management. The approach also supports other process-oriented principles for sustainable development: IRM is explicitly proactive, consultative, integrating, coordinating, focused, and adaptive. Attention to

ecosystem maintenance, social priorities for resource use, and the devolution of responsibilities to communities suggests support for substantive principles as well.

Coming earlier in the analysis, IRM may have appeared to be close to recognizing the nature of our "new animal"; at this stage, experience with other frameworks suggests a more cautious evaluation. Like AEAM, IRM adheres to virtually every process-oriented principle but is less committed to the substantive principles, none of which is heavily emphasised in descriptions of the approach. While it may be argued that a strong process-orientation combined with a low level of support for substantive principles is the integrative solution to conflicting priorities, the sustainable redevelopment and impact zoning approaches have suggested that a focus on process cannot be expected automatically to engender real commitment to the substantive principles. Indeed, token service to a wide range of principles may serve to obscure the difficulties, tensions, or challenges posed by the simultaneous but continually shifting demands of a diverse set of requirements for sustainable development.

Notwithstanding these caveats, IRM must be acknowledged as one of the most promising approaches to decision-making for sustainable development, because of its wide-ranging support for the eight principles.

SUPPORT FOR SUSTAINABLE DEVELOPMENT IN APPROACHES TO ENVIRONMENTAL ASSESSMENT, PLANNING AND MANAGEMENT

The review of the nine approaches has pointed to certain patterns in support for the two types of principles for sustainable development. Overall, process-oriented principles were better supported than were substantive principles, and, as expected, the more comprehensive approaches supported more of the principles overall.

Of the *process-oriented principles*, those related to systems analysis and adaptive strategies received the most attention in the narrower, EIA frameworks, and goal-seeking and interactive organizational principles took on a higher profile in the broader approaches.

Few of the approaches placed any emphasis on the *goal-seeking* aspect of process, possibly reflecting an assumption that resource management goals and priorities should be set by policy-makers rather than by those who undertake planning and management for implementation. Approaches that did place a priority on goal-seeking stressed the pro-active themes of creativity, initiative and implementation. AEAM, for instance, suggests that designs that work with natural forces provide the opportunity for the enhancement of natural systems, and not just their protection.

Systems or relational principles were supported by all the approaches, emphasising the characterization of specific ecosystems under threat of impact. Fewer approaches thoroughly addressed the nature of human systems and their interaction with biophysical ones, as required for sustainable development. While all frameworks recognized the need to consider spatial and temporal scales, this was often to place boundaries on assessment studies rather than to identify interconnections between occurences at different time and geographical horizons. Similarly, focusing in assessment systems was justified more in terms of economic efficiency than to enhance the sustainable development priorities for learning and problem-solving.

The *adaptive* principle was also subject to wide variations in interpretation. Most approaches

emphasized reducing uncertainty through better science and forecasting techniques while some stressed the inevitability of unexpected events and the need to be prepared for these by maintaining diversity and resilience in systems. One area of consensus on the theme of adaptation was in the area of learning and experimentation. Monitoring and the collection of baseline data are now recognized as being as crucial to the accumulation of understanding and experience as they are to the ongoing regulation of projects and mitigation of impacts. The impact hypothesis framework centres on this priority. This emphasis on learning has the potential to enhance support for virtually all the principles of sustainable development, as experience proves their worth.

Support for the *interactive* principle increased dramatically through the progression of frameworks from EIA to comprehensive planning and management. Collaboration, consultation and participation are increasingly appreciated as processes for improving both technical and regulatory control over the impacts of development, through agreement on objectives and appropriate methods. Some approaches stressed the need to improve communication. Several looked to institutional integration for the coordination of management activities. This latter focus sometimes implied a highly centralized approach to control over resource use, with the potential to constrain support for the substantive principle of social self-determination.

Fewer patterns are observable in support for substantive principles. Ecological integrity was the main substantive priority reflected in the approaches, with the human and societal principles being relatively neglected. As with the process-oriented principles, the more comprehensive approaches generally reflected a higher level of support.

The overall low level of support for the substantive principles could have a number of causes. First, the designers of the approaches may have decided that matters of substance rather than process lay outside the realm of environmental assessment, planning and management - like the goal-seeking principle, in the domain of the policy-maker. Secondly, they may have assumed that the process-oriented principles upon which the frameworks are based would automatically lead to the promotion of the substantive principles. Here I would contend that while attention to process is of the utmost importance in environmental decision-making (eg Wondolleck 1985), the challenge of sustainable development demands that we place as much emphasis on the nature of our decisions as on the ways that we make them, from the outset. Thirdly, the technical and scientific backgrounds of the authors themselves may have precluded the consideration of such qualitative factors as justice and culture. These latter concerns simply do not mesh with the disciplinary training of many professional resource planners and managers.

Differences in levels of support for the principles point to a difficulty in meeting all eight simultaneously which is related to tensions and even paradoxes in the design of approaches to management that will direct us toward sustainable development. These tensions usually arise from variability in complementarity among principles at different levels or scales of application, as described by Regier and Baskerville (1986) in the context of sustainable redevelopment. The more comprehensive approaches like integrated resource management are able to support a broad range of principles in part because their high level of abstraction removes them from the consideration of the conflicts that are encountered in dealing with detailed multiple needs and levels of management. Approaches focussed on process, like bargaining for impact assessment, monitoring and management, while confronting the challenge of conflict resolution, provide no substantive guidelines as to the range of solutions that would be acceptable in terms of sustainability. Assessment-oriented approaches like cumulative effects assessment or impact zoning do declare an allegiance to certain substantive principles - usually ecological ones, but in

the process they jeopardize support for others - usually those associated with local control and self-determination.

The dilemma posed by this apparent exclusivity amongst principles brings us back to the question, What kind of animal is this sustainable development? Although it is behaving like an elusive phantom, I believe that it is as substantial as an elephant, and that its parts are something close to the eight principles defined at the beginning. The catch is that all eight parts must be healthy and functioning harmoniously. So how are the blind men - the nine approaches - doing? I submit that, if they were to combine their efforts, they would not only recognize the sustainable development animal; they would find they have *most* of the ingredients for its care and feeding at their disposal. If they were to reach *beyond* their colleagues, they would find some essential missing ingredients in other approaches. In the remainder of this report I will summarize the ingredients provided by the nine approaches reviewed here and I will name some alternatives in which may be found the necessary supplements.

The approaches to environmental assessment, planning and management reviewed here are well on their way to incorporating principles for sustainable development in the areas of goal-seeking, relational, adaptive and interactive processes; and several of them also support principles of environmental integrity. Even traditional EIA, especially when strengthened and focused by the "ecological framework", plays an essential role in making us aware of the environmental consequences of our actions and in institutionalizing a public forum for the making of tradeoffs. A more flexible and widely applied approach to EIA could extend these benefits to other phases and other levels of decision-making. But to overcome the constraints of the narrowness and the limited reactive nature of EIA, the approach must be used in conjunction with other approaches.

Impact hypothesis statements and cumulative effects assessment inject a more systemic and longer term perspective into impact assessment, and audits of EIA processes encourage more of a learning approach and permit a policy orientation. Bargaining and negotiation ensure the representation of different interests, including the community, in decision-making processes which go beyond EIA to environmental monitoring and management. Impact zoning and adaptive environmental assessment and management provide tools for a more pro-active or goal-seeking approach, knitting together ecological and development priorities. Sustainable redevelopment recognizes that we are often not starting with the conditions that we would want to sustain, and it provides an approach for moving towards sustainability that takes into account the problems of acting locally in an environmentally sensitive way. Finally, integrated resource management frames decision-making as a truly interactive and multipartite approach which conceivably could provide a context for all of the other approaches.

Regardless of this considerable promise of the combined wisdom of the nine blind men, a substantive part of the sustainable development animal is still neglected. The approaches reviewed pay little direct or explicit attention to the satisfaction of human needs, the achievement of equity and social justice, and provision for social self-determination and cultural diversity (with the exception of sustainable redevelopment). Earlier, I pointed out the need to look beyond the nine approaches reviewed here. I suggest that the missing components may be found in non-technocratic, "grass-roots" alternatives such as bioregionalism, voluntary environmental stewardship, traditional native ways of interacting with the environment, community-based development, co-management of common property resources, and land trusts. I describe these alternative approaches as non-technocratic in the sense that their progenitors are less likely to be professionals and they come from communities rather than institutions; their derivation is more

experiential than expert; and their methods are rooted in feelings and world views as much as in scientific rigour. These approaches do not shy away from the consideration of values and the pursuit of ideals like social change, peace, human rights, the inherent worth of nature, and an end to poverty.

A wealth of experience in progress towards sustainable development through these alternative approaches to environmental management remains to be tapped. I expect it would shed light on substantive components of sustainable development that most of the blind men have been missing. At the same time, decision-making for sustainable development could be enhanced through closer attention to the kinds of approaches examined here. If approaches to environmental assessment and management are to offer the fullest support for sustainable development, their potential should be investigated within their operational context, going beyond the theoretical perspective of this study. In other words, the promise for support of sustainable development identified here needs to be confirmed by a review of multiple applications of the approaches, and by ongoing testing of them against the principles for sustainable development. At the same time, the principles themselves will be further explored and tested, so that we become ever more familiar with our new animal and the best ingredients for its care and feeding.

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INTEGRATING ECONOMY/ECOLOGY: TOWARD A ROLE FOR ENVIRONMENTAL ASSESSMENT IN SUSTAINABLE DEVELOPMENT

by William E. Rees, Ph.D.

INTRODUCTION

Our Common Future, the report of the United Nations "World Commission on Environment and Development" (WCED 1987), has stimulated unprecedented levels of public discussion of the tensions between environment and the economy in the growing number of countries where it is available (MacNeill 1988). Much of this interest stems from the intriguing concept of sustainable development. To a world served up daily with news of worsening famine, encroaching desertification, accumulating greenhouse gasses, and depleting ozone, the double-barrelled optimism implicit in "sustainable development" has nearly universal appeal. Of course, there is considerable debate over what the concept means in **practical** terms. In this paper I adopt what some might see as a radical interpretation of sustainable development, and explore the expanded role it provides for environmental assessment.

Sustainable Development and the Paradox of Growth

According to the World Commission, sustainable development is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." The Commission defined needs as the "essential needs of the world's poor, to which over-riding priority should be given." It also recognized the "limitations imposed by the state of technology and social organization on the environment's ability to meet (those needs) (WCED 1987, p. 43).

To some ears, such words are a clarion call for political recognition of global economic injustice and environmental limits. But there is another side to *Our Common Future* that weakens its central message while enhancing its political acceptability. The Commission found it necessary to equate sustainable development with "more rapid economic growth in both industrial and developing countries" in apparent faith that "economic growth and diversification ...will help developing countries mitigate the strains on the rural environment, raise productivity and consumption standards, and allow nations to move beyond dependence on one or two primary products for their export earnings" (WCED 1987, p. 89). Accordingly, the Commission suggests

"a five- to tenfold increase in world industrial output can be anticipated by the time world population stabilizes some time in the next century" (WCED 1987, p. 213).

To those who regard present levels of industrial activity as the root cause of global environmental decline, the Commission's appeal for a "revitalization" of global economic growth on this scale seems paradoxical at best. Their worst fears are realized when others seize on this element of the UN report in resounding defence of the status quo.

Purpose and Scope

Without denying the need for some forms of growth, this paper prefers the more revolutionary interpretation of the World Commission's message. I start from the premise that we are indeed confronted with global environmental and socio-political problems of a kind that necessitate a shift to "sustainable" forms of development. I also believe that environmental assessment (EA), broadly defined, can play a significant role in this transition. The central purpose of the paper, therefore, is to explore some of the conceptual and practical ways that EA-related activities might contribute to implementation of truly sustainable development.

At the same time, I don't believe we can sail smoothly into the safe harbour of sustainable development through simple reform of EA and the regulatory environment. By adopting a radical approach, I'm implying that Western society needs to take a hard look at where it is "coming from" to have arrived at its present dilemma. We have to consider seriously whether a change in our basic beliefs and perceptions isn't essential to get us where we want to go. Thus, even to posit an extended role for environmental assessment requires first an examination of the socio-cultural roots of our so-called environmental crisis, and the ecological realities in which they are embedded. The following section therefore calls to question our cultural paradigm or world-view, thereby posing a more substantive challenge to current developmental philosophies than is explicit in *Our Common Future*. It also provides the context for our discussion of an extended role for EA.

THE LEGACY OF SCIENTIFIC MATERIALISM

The "world-view" that presently dominates western society is rooted in 19th century scientific materialism (Waller 1980). Building on the experimental "natural philosophy" of the previous 200 years, the late 1800s saw the deep entrenchment of scientific rationality and its companion, social utilitarianism, as the engines of human progress.

Descartes had set the stage in the 17th Century with his division of reality into the separate and independent realms of mind and matter. This "Cartesian" division encouraged people to see themselves as separate and distinct from a physical reality "out there," and provided the perceptual framework for all subsequent scientific enquiry. But it was Bacon who gave modern science its raison d'etre by arguing that knowledge gained through science should be put to work. "From this perspective, knowledge is regarded not as an end but as a means, expressed and applied in technology, by which humans assume power over the material world" (Jones 1988, p. 236)

The resultant flowering of science and technology made possible the industrial revolution and unprecedented levels of material production. Not surprisingly, scientific method[1] became

associated with a glowing material future, while traditional thinking and values were scorned as obsolete and reactionary. Indeed, science came to be equated with the only true knowledge. "Facts" that have no authority of science behind them, are written off "as having no epistemological status at all" (Jones 1988, p. 237). The scientific world-view had succeeded in separating material knowledge from values, and asserted the primacy of the former over the latter (Skolimowski 1981, p. 3).

This materialistic, rational empiricism remains the dominant paradigm of western society. To judge from economic behavior, we see the external world, the biosphere, mainly as a warehouse to be plundered in satisfaction of the material needs and wants of humankind. Certainly reductionist science remains our only acceptable analytic mode. Society's prevailing ecological myth sees "the environment" in terms of isolated, individual resources or, at best, as a mechanical construction, whose component parts are bendable to human will and purpose. Even the organization of governments frequently reflects this analytic perspective. Environmental management is institutionally segregated into Departments of Fisheries, Forests, Lands and Water, Energy and Mines, etc., with little regard to interdependent properties of the whole. Ironically, at least in Canada, this often leaves our federal and provincial Departments of Environment with little to do!

Economic Assumptions

Modern economics springs from the same historical roots. The founders of the neoclassical school, impressed with the spectacular successes of Newtonian physics, strove to create economics as a sister science, "the mechanics of utility and self-interest" (Jevons 1879, cited in Georgescu-Roegen 1975).

The major consequence of this mechanical analogue is a traditional view of economic process as "a self-sustaining circular flow between production and consumption within a completely closed system." By this perception, "everything...turns out to be just a pendulum movement. One business 'cycle' follows another... If events alter the supply and demand propensities, the economic world returns to its previous position as soon as these events fade out."

This contrived equilibrium orientation enables mainstream economists to ignore the implications of the de facto transformation of material resources in their continuous exchange between the environment and the economy, and the unidirectional flow of free energy from biophysical environment to the economy.[2] Rather, in economics "**complete reversibility** is the general rule, just as in mechanics" (Georgescu-Roegen 1975, p. 348, emphasis added). Thus it is a corollary of the equilibrium model that any damage to environmental processes caused by human activity is inconsequential or reversible.

A second corollary of equilibrium theory is that continuous growth is theoretically possible (see Simon and Kahn 1984). Indeed, many economists still seem to believe "not only in the possibility of continuous material growth, but in its axiomatic necessity" (Georgescu-Roegen 1977). This "growthmania" (Mishan 1967) "has given rise to an immense literature in which exponential growth is taken as the normal state of affairs" (Georgescu-Roegen 1977).

That growth is entrenched as the measure of progress is evident from a glance at the business pages of any daily newspaper. The annual percent increase in gross national product (GNP) is still taken as every nation's primary indicator of national health. Rates of under 3% are

considered sluggish, and most politicians and economic planners don't feel at ease until real growth in GNP tops 4% per annum. While such rates may seem modest, even a 4% increase implies a doubling of economic activity in a mere 17 years!

With its fixation on growth, the resurgent conservatism of the 1980's increasingly demands that people accept the rigorous discipline of the marketplace as the primary wellspring of value and social well-being.[3] Businessmen and technocrats are the heroes of the new age and the dominant role models for youth. The competitive ethic provides the proving ground for self worth, with individual success measured in terms of conspicuous consumption and the accumulation of personal property. In some circles it is fashionable to be socially unconcerned and aggressively oblivious to environmental destruction. While individual rights are loudly proclaimed, there is telling silence over matters of social responsibility.

It is no coincidence that capitalist states depend on the increasing size of the national economic pie to ensure that the poor receive enough of the national wealth to survive. Indeed, it is not exaggerating to say that economic growth is the major instrument of social policy. By holding out hope for improvement, it relieves the pressure for policies aimed at more equitable distribution of wealth.

The Ecological Reality [4]

There are two ecological problems with common economic expectations. First, as noted, the expanding economic system is inextricably linked to the biosphere. Every economy draws on the physical environment for non-renewable resources and on ecosystems for renewable resources, and all the products of economic activity (i.e., both the waste products of the manufacturing process and the final consumer goods) are eventually discharged back into the biosphere as waste.

The ultimate regulator of this activity, and one that modern economic theory ignores, is the second law of thermodynamics (the entropy law): **In any closed isolated system, available energy and matter are continuously and irrevocably degraded to the unavailable state.** (See Georgescu-Roegen 1975, 1977.) The effect of this law is to declare that all material economic "production" is really "consumption"!

Modern economies are dependent on fixed stocks of certain material and energy resources. Thus, the Second Law dictates that they necessarily consume and degrade the very resource base which sustains them. The substitution of one depleting resource for another can only be a stopgap on the road to scarcity. Even resource recycling within the economy has a net negative impact on remaining stocks of available energy and material. In short, all economic activity contributes to a constant increase in global net entropy (disorder), through the continuous dissipation of free energy and matter. Contrary to the assumptions of neoclassical theory, **there is no equilibrium of any sort in the material relationship between industrial economies and the environment.**

This means that the growth of many national economies (e.g., Japan, the US) can be sustained only by continuous resource imports from elsewhere, and only for a limited period. The global economy, for all practical purposes, is a closed system, a reality that is little affected by shuffling resources around (world trade). Thus, contrary to the implicit assumptions of neoclassical economics, **long-term sustainable development based on prevailing patterns of resource use is**

not even theoretically conceivable.

The second ecological difficulty with the growth-dependent economy stems from the functional dynamics of ecosystems themselves. Ecosystems, like economic systems, depend on fixed stocks of material resources. However, the material resources of ecosystems are constantly being transformed and recycled throughout the system via food-webs at the local level, and biogeochemical cycles on a global scale. In addition, evolution and succession in nature tend toward greater order and resilience.

The material cycles and developmental trends of ecosystems thus appear at first glance to defy the thermodynamic law. **Ecosystems seem to be inherently self-sustaining and self-organizing, and therefore to contribute to a reduction in global net entropy**. This is possible only because ecosystems, unlike economic systems, are driven by an external source of free energy, the sun. Through photosynthesis, the steady stream of solar energy sustains essentially all biological activity and makes possible the diversity of life on earth.

Material recycling - the self-renewing property of ecosystems - is the source of all renewable resources used by the human economy. Moreover, since the flow of solar radiation is constant, steady, and reliable, **resource production from the ecological sector is potentially sustainable over any time scale relevant to humankind**.

But only potentially. Even ecological productivity is ultimately limited, in part, by the rate of energy input (the "solar flux") itself. Ecosystems therefore do not grow indefinitely. Unlike the economy, which expands through intrinsic positive feedback, ecosystems are held in "steady-state" or dynamic equilibrium, regulated by limiting factors and negative feedback

Why is this significant? First, human beings and their economies are now a dominant component of all the world's major ecosystems. Since these economies are growing and the ecosystems within which they are embedded are not,[5] the consumption of ecological resources everywhere threatens to exceed sustainable rates of biological production. Second, over-exploitation is exacerbated by pollution which impairs the remaining productivity of ecosystems.[6] (Recent reports that acid rain may be reducing rates of tree growth by as much as 25% in parts of eastern North America serve as a timely example.)

Modern industrial economies thus both **directly** undermine the potential for sustainable development through over-harvesting, and **indirectly** compromise future production through residuals discharge. If, as many scientists believe, these trends have the potential to inflict inestimable damage on whole regions and even global society, **it is the entire present pattern of growth-driven economic development, not just a particular project or economic sector, that is ultimately unsustainable**.

The point here is not to argue for abandonment of scientific rationality or even the entire growth paradigm. Science, technology, and the human ingenuity to use them, are among the key factors required for sustainable development. What I do wish to stress is that our current world-view, however successful when the industrial world was young, is a dangerously shallow perception of present reality. The accelerating decline of the biosphere is evidence that many of its basic assumptions are simply wrong.

STRUGGLING WITH SUSTAINABLE DEVELOPMENT: CAN THE PROBLEM PROVIDE THE SOLUTION?

That so problematic a paradigm is unlikely to provide appropriate solutions may seem self-evident. Nevertheless, scientific materialism is the likely hidden source of the growth-as-solution orientation of the UN World Commission, and certainly inspires much of the nervous reaction to the Commissions's report. This section explores why this might be so.

Our Common Future defined sustainable development as development that meets today's needs without compromising the ability to meet future needs. Nothing very threatening or controversial here. By contrast, taking our previous discussion into account and defining sustainable development as: **a goal-oriented process for positive socioeconomic change that does not erode the ecological, social, or political systems upon which society is dependent,** suggests some of its more troublesome implications. This definition makes clear that sustainable development is a complex social process which:

1. is value-laden (oriented to achieving explicit ecological, social, and economic objectives);

2. requires deliberate planning and coordination at all spatial scales and a degree of government intervention;

3. may impose ecological limits on material growth (while fostering qualitative growth at the individual and community levels);

4. needs the full understanding and support of the people (for political viability), and therefore;

5. demands educational, planning, and political processes that are informed, open, and fair.

Clearly distributive equity would also become a central consideration. The World Commission reported that the 26% of the world's population living in developed countries consumes 80-86% of non-renewable resources and up to 34-53% of food products (WCED p. 33). Ecological and moral considerations suggest that reducing the present gap in standards of living between the rich and poor (between and within nations) may well require that the rich reduce both present consumption and future expectations so that the poor may enjoy a fairer share of the world's resources. (Examples of sustainable and unsustainable development are listed in Appendix 1.)

This interpretaton suggests that hardly any area of socio-political relevance would be unaffected were we seriously to implement sustainable development. The problem is that the interventionist policies, environmental determinism, and cooperative social relationships required for sustainable development fly in the face of such current conservative trends as deregulation, privatization, and uncritical worship of the free market economy. Little wonder that the more profound implications of the concept remain invisible from (or are repressed by) the mainstream perspective.

For example, Canada was the first nation to respond with its own policy initiative to the work of the World Commission. The National Task Force on Environment and the Economy

(NTFEE) was established in October 1986 to initiate dialogue and recommend action on environment-economy integration in Canada. Its subsequent report (CCREM 1987) is regarded by the government and industry as a milestone document, but with suspicion by environmentalists and other critics.

Stepping to the right of the World Commission, the Task Force report defines sustainable development as "development which ensures that the utilization of resources and the environment today does not damage prospects for their use by future generations." The report goes on to state that at the core of the concept is the requirement "that current practices should not diminish the possibility of maintaining or improving living standards in the future." Also: "Sustainable development does not require the preservation of the current stock of natural resources or any particular mix of... assets. Nor does it place artificial limits on economic growth, provided that such growth is economically and environmentally sustainable" (CCREM 1987, p. 3).[7]

This definition is self-contradictory and thus difficult to interpret rationally. First, as previously emphasized, the present generation cannot use any non-renewable energy or material resource (e.g., oil, natural gas, phosphate ore) without **totally eliminating** the prospect for its use by future generations. Thus, the main part of the definition is simply invalid. Second, the NTFEE is reluctant to admit the possibility that living standards for some may have to be reduced that others might live at all. It avoids this issue entirely. Third, and consistent with the foregoing, the Task Force clings to the growth ethic, implying that an expanding economy is the preferred solution to social inequity. Fourth, the Task Force disallows the possibility that the preservation of certain "mixes" of ecological resource systems may well be essential to sustainability.

On the positive side, the NTFEE does go on to make numerous recommendations for demonstration projects of sustainable development; for more research into ecological problems; for better government-industry cooperation in the integration of environment and economy; for improved economic planning; for extended use of environmental assessment. However, in failing to recognize its own epistemological assumptions, the Task Force was precluded from stretching beyond such marginal adjustments. In the final analysis, the Task Force conception of sustainable development could be used to defend practically any pattern of economic activity, including the status quo (which may have been the general idea).

Let's be clear that the NTFEE was by no means insincere in its deliberations - there is a grand idea in the Task Force report struggling to get out. But the fact there was a struggle is the critical point. The materialist paradigm contains neither the vocabulary nor the concepts necessary for sustainable development. Trapped within the prevailing worldview, society can only conceive ways to force nature to continue meeting our growing demands; it is literally **beyond imagining** that we should adapt our needs to the constraints of the natural environment.

THE PRACTICE OF ENVIRONMENTAL ASSESSMENT: A CRITIQUE

Designing an effective role for EA in the context of sustainable development requires an understanding of its current scope and effectiveness. While the following critique refers specifically to Canadian experience, the main arguments apply also to the US and other countries.

Most references to formal EA refer to the process and activities designed to identify, predict, and evaluate (preferably quantitatively) the likely environmental consequences of a specific

development or policy proposal. For example, according to the Guidelines Order describing the Canadian Federal Environmental Assessment and Review Process (EARP), the process theoretically applies to "any proposal for which the Government of Canada makes a financial commitment" or "that is located on any lands.... that are administered by the Government of Canada" (emphasis added). The term "proposal" means "any initiative, undertaking, or activity for which the Government of Canada has a decision-making responsibility" (Canada 1984).

This language is clear and unambiguous. A rational person reading the Guidelines Order would be justified in believing that all environmentally significant federal projects, programs, policies, and routine regulatory or management activities are already being systematically assessed for environmental effects, and modified accordingly.

This would be a false impression. From the beginning of EARP in 1974, only a limited number of localized proposals, primarily capital projects involving physical disturbance of the environment, have been assessed (FEARO 1986-87, Rees and Boothroyd 1987b). This means that EA typically does not address many important public initiatives affecting environmental quality. The impacts of many national and provincial policy decisions, regulated activities, and routine management procedures are collectively greater than those of capital works, but are simply not covered by the process.

Consider the cumulative environmental effects of policy and management initiatives in such matters as transportation, international trade, tax incentives (e.g., write-offs and depletion allowances for oil and gas development, the nuclear industry, etc.), energy conservation, energy production, urbanization, farm subsidies, agricultural technology (e.g., routine irrigation, cultivation, soils management, insecticide and herbicide use), fisher-ies and forest management practices, pollution permits, water licences, waste disposal, predator control, road maintenance, arms production, etc. There is no evidence that any policy or program in these areas has been the subject of an EARP screening or initial environmental evaluation, let alone a full public review. It should also be noted that existing impact assess-ment requirements generally do not apply to purely private sector proposals (which implicitly affirms the primacy of private economic interests over public environmental values).

These major gaps in EA practice are not acceptable. Sustainable development requires that the scope and institutional mechanisms for EA-like endeavors be extended to capture the full range of human activities significantly affecting the environment. (Even the NTFEE implicitly recommended the extension of EA to the environmental implications of policy proposals) (CCREM 1987, p. 8).

This is not to suggest that the assessment of capital projects is presently adequate. In many jurisdictions EA is not rigorously applied even to this limited realm. This can be ascribed to the principle of self-assessment and the conflict of interest it implies (proponents initiate the process and prepare the EA document); the growth-oriented ideology of most governments; the low political status of environmental issues; and, at least in Canada, excessive political discretion in invoking the process and an institutional framework that seems designed to circumvent political accountability (Emond 1983, Rees and Boothroyd 1987a,b).[8] Such institutional frailty and political indifference are clearly inimical to creating a satisfactory role for EA in sustainable development.

Other structural weaknesses must also be addressed in this context. First, most EA is still conducted on a reactive, project-by-project, short-term basis. This conceptual approach is another

product of the positivist paradigm. It reflects our 1960's perception of environment and society as mechanical systems amenable to analysis and manipulation. In effect, standard practice assumes perfect knowledge of "the environment" and the ability to make accurate predictions of ecological and socioeconomic impacts. These assumptions obviate the need for impact monitoring, while the single project focus of typical assessments ignores the cumulative effects of incremental development. The absence of a wider planning context for EA is also compatible with the prevailing laissez-faire attitude toward development.

Nearly 20 years of EA practice have shown this approach to be inadequate if not naive. Important behaviors of complex dynamic systems under stress have proved not to be readily predictable, and may well be inherently intractable to practical analysis (Holling 1978, Willard 1980, Lang and Armour 1981, Suter 1981, Barnthouse et al. 1984). Meanwhile, cumulative effects are proving to be "environmental destruction by insignificant increments" in the absence of any broader evaluative context.

Consequently, there is a trend in biophysical assessment toward supplementary project audits and effects monitoring for purposes of "adaptive management." Similarly, social impact assessors are gradually moving from predictive methods designed to manipulate affected communities, toward socio-political approaches designed to empower communities in acquiring greater control over externally imposed development (Boothroyd 1982, Daneke et al. 1983, Halstead et al. 1984, Boothroyd and Rees 1984, Corbett 1986). As part of this, certain cooperative procedures such as multi-party negotiation are emerging as useful supplements to technical EA studies in circumstances where there are significant interest-group conflicts (Dorcey and Riek 1987). Even cumulative impact assessment has begun to attract unprecedented official attention (CEARC 1986, Sonntag et al., 1987).

All such trends are encouraging. For compatibility with sustainable development, EA should incorporate social learning and be structured for continuous managerial and political adaptation to unexpected environmental change (IIASA 1979, Holling 1986).

Finally, and perhaps most important, EA is typically still a reactive, quasi-regulatory instrument, expected to have only a marginal effect on project design and implementation. The economy and the proposal are considered to be the independent or driving variables, and the environment and EA the dependent ones. By contrast, sustainable development requires a proactive planning approach in which ecological integrity is the governing factor and the permissible level of economic activity is the dependent variable.

In sum, present EA practice, like the world-view that spawned it, is ill-suited to the requirements of sustainable development. However, our discussion does suggest four initial steps in re-creating EA to serve a viable role in sustainable development:

1. Extend the scope of EA-like activities to cover the full range of ecologically and socially relevant public and private sector proposals and actions;

2. Create a variety of institutional frameworks for EA adapted to the increased diversity of initiatives and activities to be assessed. These mechanisms should be balanced, reduce conflict of interest, and promote political accountability (see Rees and Boothroyd 1987b).

3. Develop methods for EA that reflect the discontinuous temporal and spatial dynamics, and

the resilience properties, of ecosystems. This requires a balance between predicting the known, and adapting socially and politically to the uncertain and unknown in the natural world (Holling 1986).

4. Implement the foregoing as part of a broader planning and decision-making framework (e.g., community development planning, regional planning) that effectively recognizes ecological functions as limiting factors.

These modest improvements would already stretch the boundaries of the current EA paradigm. However, if EA is to contribute significantly to reversing global environmental trends, the conceptual framework and context for implementation needs further development.

SUSTAINABLE REGIONAL DEVELOPMENT: A CONTEXT FOR ENVIRONMENTAL ASSESSMENT

This section outlines how improved EA could be incorporated as an essential component of a regional approach to global sustainable development. The proposed model is radical by today's standards because of its explicit acceptance of ecological constraints on human activity, and its recognition that we, rather than the environment, are the problem. Successful implementation of any such approach will depend on a shift in societal perceptions. Indeed, the evolution of a modified world-view may be an essential prerequisite. This may already have started, through enlightened self-interest in the fatal implications of global ecological deterioration.

Let's be clear that by "modified world-view" I am not referring merely to tougher environmental regulation or better methods for EA.[9] Although necessary in the transition, restrictive measures alone are never wholly effective because they must be **imposed** to protect social values that are perceived as secondary if not inimical to the interests of the regulatee.

By contrast, truly self-sustaining development cannot be forced; it would be the **natural product** of a society that "comes from" a sense of being in, and of, the natural world. Ultimately, were people to acquire a sense that violation of the biosphere is violation of self, it would be psychologically and socially unconscionable for anyone to advance an ecologically bankrupt development.

Cumulative Effects and the Regional Connection

A major force behind the call for sustainable development is concern about the cumulative environmental and social effects of human activity at all spatial scales. Many of the most best known ecological problems such as disappearing forests, acid rain damage, the thinning ozone layer, and changing global climates, are the cumulative result of expanding economic activities around the world.

Cumulative impacts result from the additive or synergistic effects of numerous incremental actions, including a major contribution from the routine functions of governments and society. (As previously noted, most of the latter are usually ignored as individually too small to be considered in environmental assessment.) Sometimes we are concerned about cumulative changes in single variables from a variety of similar sources, sometimes about the impacts on numerous variables from various unrelated activities.

Society frequently takes little notice of gradual changes in environmental parameters until it is too late for effective mitigative action. As often, however, the homeostasis and resilience (negative feedback) of ecosystems "absorb" incremental impacts for long periods without obvious ill effect. This produces a false sense of security that all is well when, in fact, we are being led into an ecological trap. In either case, the resultant inaction means that a straw is added that breaks the proverbial camel's back. A species, a valuable fishery, or a whole ecosystem may be lost, possibly forever.

Planning for sustainable development will obviously require systematic identification and monitoring of cumulative negative trends in significant environmental variables. Whether these trends are driven wholly by local-regional activity or are the result of more global factors, the necessary corrective action must be implemented in all jurisdictions on a site-specific basis. This suggests that cumulative effects assessment and management might best be carried out on a regional basis. For this purpose, it will probably be necessary to divide existing political units into functional planning regions based on such ecological criteria as climatic and vegetation patterns, soil classification, and watershed boundaries.

Regional Carrying Capacity

Measuring cumulative effects has no practical utility unless it is in relation to permissible limits of ecological or social impact. This in turn implies the existence of physical limits to development and economic activity, and invokes the concept of carrying capacity.[10] Development within carrying capacity recognizes that humankind is dependent on the productive capacity of ecosystems and that some minimal level of ecosystems integrity is therefore essential to human survival.

For most animal species, carrying capacity is defined as the maximum population that can be supported indefinitely in a given habitat without permanently impairing the productivity of the ecosystem(s) upon which that population is dependent. For human society, regional carrying capacity can be defined as the maximum rate of resource consumption and waste discharge that can be sustained indefinitely in a defined planning region without progressively impairing bioproductivity and ecological integrity. The corresponding human population is therefore obtained by dividing total ecosystem capacity by mean per capita rates of resource consumption and waste production.

An understanding of carrying capacity provides a functional definition of sustainable development. In ecological terms, any level of development or economic activity that does not exceed the carrying capacity of the planning and management region is sustainable. Conversely, development that consistently degrades the ecosystems upon which the regional population is dependent exceeds carrying capacity and is not sustainable for long. [11]

It should be noted that while human society depends on many ecological resources and functions for survival, **carrying capacity is ultimately determined by the single vital resource or function in least supply.** (Loss of the ozone layer alone could conceivably do us in.)

Note also that working within carrying capacity does not preclude some environmental damage in the course of development (buildings and roads must occupy some space); nor does it preclude using nature's services (e.g., organic waste processing and recycling) to capacity. The key is to ensure that sufficient stable ecological capital remains in place to support the anticipated

dependent population indefinitely at an acceptable standard of living.

A Role for Environmental Assessment

It is already obvious that to achieve sustainable levels of economic activity within carrying capacity, society would have to adopt more rigorous and environmentally deterministic approaches to regional planning than at present. Long-term ecological factors rather than short-term market forces would be the primary determinants of land use and resource management decisions as limits are approached.

As noted, persistent deterioration in key ecological variables could not be tolerated. Land use and development patterns would be controlled under sustainable use planning criteria. Each planning region would therefore have to undertake a comprehensive inventory of lands, water, and associated ecological resources, and implement an ambient environmental quality monitoring program. In effect, comprehensive regional monitoring would become an operational form of cumulative environmental assessment (CEA). Within the sustainable development framework, CEA would provide the means to estimate how close we are to developmental limits specified and imposed by the carrying capacity considerations of the regional plan.

This approach also provides the missing context for project-specific EA. Critics of "traditional" EA have long observed that in the absence of a broader policy and planning context, without knowing potentially competing resource uses and values, it is impossible to assess the "significance" of impacts associated with isolated projects. By contrast, the carrying capacity framework enables individual project impacts to be evaluated, as they should be, in light of preceding development, opportunity costs, and the remaining capacity of biophysical and social systems to cope with stress. Meanwhile, project-specific assessments would provide data for the on-going cumulative environmental assessment program, and an opportunity to test specific hypotheses on environment-development relationships.

THE PROBLEM OF INTER-REGIONAL TRADE

While the notion of carrying capacity is conceptually simple, various factors make it difficult to put into practice. For example, inter-regional flows and commercial trade in ecological goods and services presently obscure the immediate people-land relationship.[12] Because they can import nature's products from outside their own territories, the populations of many regions today unknowingly exceed their local carrying capacity with apparent impunity. In the absence of feedback from the land on their life-styles or economy, there is no direct incentive for such populations to practice sustainable management of local resources. The psychological effect is that people forget their "obligate dependency" on the natural environment. Why should British Columbians be concerned about the urbanization of their limited Class 1 farmland when they can always import food from Mexico and California?

The problem is, that as one region's population destroys its own environment, it becomes dependent on apparent excess carrying capacity "imported" from other regions over which it has no direct management control. In these circumstances, the populations of some surplus regions could not then rise to the level of their own regional carrying capacity without potentially harming people in dependent import regions. We should also recognize that the perceived need for foreign exchange already drives some developing countries to export **non-surplus** carrying capacity, thereby jeopardizing staples production and harming their own people.[13] Neither

situation is sustainable.

These last points become potential foci for policy development when we realize: a) there is generally no permanent commitment by export regions to dependent regions, and; b) management practices in the export regions may be undermining ecosystems there as well.[14] Thus, under a carrying capacity approach to sustainable development, inhabitants of significant trading regions might want to contractually formalize their relationships. The necessary negotiations would be oriented to creating a morally and politically acceptable basis of exchange, and serve a valuable educational function. Documenting the nature of inter-regional dependencies, would both increase public awareness of ecological realities, and contribute to inter-regional equity. For example, importers would have to pay a price not currently accounted for in the market, for reserving extra-territorial carrying capacity. At present, the residents of developed countries are not even aware of the impacts their imports of luxury crops have on such factors as staples production, land use and ownership patterns, and ecological conditions, in exporting developing counties.

Although inter-regional trade reduces the incentive to husband local ecosystems, making it politically more difficult to implement a carrying capacity approach, trade per se is not at fault. For example, if by adopting an ecological development paradigm, the population of each planning region were to achieve intra-regional stability (i.e., no progressive environmental degradation) **regardless of its trade balance**, the cumulative effect would be a sustainable level of development within global carrying capacity (which is, after all, the whole point of the exercise).

Ecological Accounts and Balance of Trade

By extension, the cumulative assessment - carrying capacity (CEA-CC) approach could be used to monitor the total consumption (demand) and production of a wide range of ecological goods and services for each planning region. With increasingly fine-grained analysis, the latter might range from market commodities such as food and forest products, to more fundamental ecosystems components not recognized per se in the marketplace, such as essential nutrients.[15]

Monitoring the relationship between cumulative demand and regional capacity for each key componment would:

- identify those vital ecological resources and functions in greatest danger of over-exploitation, and thus provide the empirical basis for policy and management initiatives to restore sustainable development; and

- make it possible to build up a crude set of ecological accounts and hence an estimate of the ecological "balance of trade" for any region, however defined, with the rest of the biosphere.

Such regional ecological accounts would graphically illustrate inter-regional dependencies and would be followed with as much interest by an informed public as economic current accounts are today. Given the need to garner and maintain public support for the more onerous implications of sustainable development, this feature is a attractive advantage of the EA-SD approach. A simple illustration of the concept is provided in Appendix 2.

CONCLUSION

Cumulative assessment and carrying capacity provide powerful conceptual and practical tools for implementing sustainable development on a coordinated regional basis. At the same time they imply an unprecedented level of socio-political control over the level and quality of economic and development activity. Before rejecting this framework as an extreme form of ecological determinism, remember that our present approach **systematically destroys** our potentially renewable ecological capital, and may therefore prove more costly and restrictive in the end. By contrast, careful regional management within even an estimate of ecosystems limits, should enable us to **enhance** the productive capacity of many regions beyond historic levels.

We should also note that cumulative capacity and sustainability merely provide the **context** for development. Numerous other considerations provide the management **content**. Such technical factors as the efficiency of energy use, the sophistication of production and waste control methods, and the level of technology generally; as well as such economic and social considerations as gross regional product, material standard of living, and material expectations, are all determinants of regional carrying capacity.[16] Since all such factors are socially and politically malleable, more policy and planning flexibility is available under the CEA-CC approach than is initially apparent.

It may make some people uncomfortable, but all such variables will necessarily become stronger foci for public policy as environmental limits are breached, **whatever** the development model. Growing official recognition of the need for environmental monitoring, for cumulative assessment, and for sustainable development itself, is ironic acknowledgment that laissez-faire must inevitably lead to an increasingly interventionist society.

APPENDIX 1

Examples of Sustainable and Unsustainable Development

Using our original definition of sustainable development, here are some practical examples:

- Aid programs that empower local people in the third world to increase food production using technology appropriate to local ecological conditions;

- Development programs that respect and enhance local adaptations to prevailing ecological conditions. (e.g. Nomadism in sub-Sahelian Africa was a cultural ecological adaptation to seasonal shifts in rainfall. Aid-abetted settlement has contributed to over-grazing, desertification, and recent famines in North Africa.);

- Limited or no-tillage organic agriculture anywhere;

• Resource co-management programs that place priority on native subsistence requirements instead of commercial or recreational demand;

• Some forms of development designed to displace nonrenewable forms of energy with renewable solar-based forms (e.g., wind and photo-voltaic electricity generation, solar heating, cooking, etc.). Solar economies, either high-tech or low tech, may be the only truly sustainable economies;

• Community development as practised by Amish, Hutterite, or other sects who disavow labour-displacing, land-destroying technological innovations in favour of human and animal labour. (Some "Old Order" communities are essentially solar-based.);

Examples of unsustainable development activities include:

• Aid programs that facilitate the concentration of land ownership, undermine local staples production, and encourage cash cropping for export. (Often required to earn money to pay off the "development" loan.);

• Related to the above, the introduction of technological "innovation" from the north temperate zone (e.g., gasoline-powered machinery, irrigation schemes, chemical fertilizers, etc.) that may have a short-term economic payoff, but are ecologically inappropriate for arid, semi-arid, tropical and sub-tropical ecosystems;

• Current machine and energy-subsidized practices in first world agriculture managed under financial and market conditions that force farmers to mine the soil.[17] (Canadian farmers have reduced the organic and natural nutrient content of prairie soils by 50-60% in 70 years; typical soil loss from cultivated lands in the US and Canada amounts to 9-12 tons/acre/year or as much as 10 times the sustainable rate (Pimental et al. 1976, SCC 1986);

• Irrigation schemes that produce short-term gains (and dependencies) but lead eventually to destructive salination of the soil;

• Use of chemical fertilizers that produce short term gains but lead eventually to loss of production due to soil acidification;

• Destruction of tropical rain forests for agricultural settlement in laterite soil areas (Most of the essential nutrients are contained in the tree biomass, and are lost in logging or burning.);

• Projects to displace petroleum-based automotive fuels with alcohol derived from energy crops, at the expense of staples food production for local people (A growing controversy in Brazil);

• Hydro-electric/irrigation projects that initially boost production and create dependencies, but which fail when the reservoirs fill up with sediment produced by similarly unsustainable forestry or agricultural practices (a common situation in the third world).

• Market-driven fisheries and forestry practices that have led to stock depletion and

destruction of future productive capacity almost everywhere, including Canada and the US.[18]

- the kinds and levels of economic activity and technology currently producing continuous deterioration in key environmental quality indicators (e.g., the buildup of carbon dioxide and other greenhouse gasses, ozone depleton, acid rain).

APPENDIX 2

Agricultural Land Accounts: the BC Case

To illustrate one use of the cumulative assessment-carrying capacity (CA-CC) approach, consider the present population and boundaries of British Columbia, Canada. To keep matters simple, we focus on the agricultural resource base, using land area as a surrogate for the whole range of depletable ecological resources upon which agriculture depends (nitrates, phosphates, and other nutrients; soil organic matter etc.).

The first step in the CA-CC exercise would be to determine per capita consumption of agricultural products by BC residents, assuming current Canadian dietary standards, and convert this to the land equivalent. This provides an estimate of the actual land area presently devoted to sustaining each member of the region's population.

Our computation would probably produce a figure close to Borgstrom's (1973) for North America, showing that each of us "consumes" approximately 1.8 acres of cropland and 3.2 acres of pastureland for a total of 5 acres (about 2 hectares). This means that some 14 million acres (5.66 million ha.) of mixed farmlands are required to support B.C.'s current population of 2.8 million. We now have a crude "cumulative assessment" of the agricultural land requirements for sustainable development at current dietary standards and technological levels.

It may be a surprise to some that there are only about 6 million acres devoted to food production in all of BC, and this includes all the best arable land. This amounts to only 2.14 ac./capita (.87 ha.) or less than half the estimated land requirements for the resident population. Not surprisingly, therefore, that BC regularly imports over half of its food requirements, including supplies of many crops also grown there.

In terms of our model, this shows us that the estimated cumulative demand for land by the present population exceeds carrying capacity of BC under present conditions, and this estimate is based on only a single indicator of land consumption. [19]

This simple exercise illustrates how the CA-CC approach raises a whole range of issues that are not normally the subject of serious policy consi-deration. For example, should BC really be considered underpopulated? What does it mean for land use and population policy when half of the agricultural resource base supporting the subject population is in the form of apparent excess capacity elsewhere? Should we be concerned that this so-called "ghost acreage" (Borgstrom's term) is under someone else's political and economic control? What are the additional

implications for achieving sustainable development when much of the agricultural land in question (both in BC and "elsewhere") is being seriously degraded by agriculture itself? How does increasing concern and uncertainty about the potential impacts of global climate change on productivity in "traditional" agricultural areas affrect our answers to these questions?

Faced with these long-term questions even the most strongly market-oriented planners might begin to think that perhaps land economics with its short-term perspective and assumption of complete reversibility, may not be the most important consideration in agricultural land use policy after all.

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NOTES

1. By method I refer to reductionist analysis, the breaking down of an observed reality into its components, in the belief that by learning the behaviour of the parts we can understand the whole.

2. Since the 1960s, environmental economics has developed as a minor tributary in partial response to this problem. However, the effect on the mainstream economic planning has been negligible.

3. Neo-conservatism may be the old capitalism's last gasp. Confronted by mounting problems, society has responded with characteristic bravado by bolstering an historically comforting illusion.

4. Ecological integrity is only one of many objectives of sustainable development (see Gardner 1988 this volume). However, unlike some others, it is a necessary condition from the outset and so is stressed here.

5. This is the source of the unsettling metaphor of humanity-as-planetary-cancer.

6. Pollution is one manifestation of the degradation and dissipation of matter and energy associated with industrial economies. It is the entropy law at work.

7. No one advocates "artificial" limits to growth, but surely there are circumstances in which we might need real ones!

8. Such factors as these inspired Livingstone (1981, p.33) to label environmental impact assessment "a grandiloquent fraud, a hoax, and a con."

9. These traditional solutions are essentially conservative, challenging "only our efficiency in being what we are." Radical nature advocacy challenges "our belief in the way the world is" (Evernden 1988; see also Evernden 1985).

10. For opposing views of the utility of this concept, see World Bank (1985).

11. As noted below, imports can temporarily obscure this reality. However, imports assume permanent access to excess carrying capacity "elsewhere."

12. This includes the movement of air and water in natural cycles throughout the biosphere, and import/export trade in fisheries, forestry, and agricultural products.

13. Ecological trade is a zero-sum game that can relieve imbalance but not overall scarcity.

14. As is the case in the BC-California example. The latter may be the most productive region of the US, but agricultural practices exceed carrying capacity as defined, and ultimately are not sustainable.

15. North Americans export "grain", but are not accustomed to thinking of it as phosphates, nitrates, etc. removed from the soil. Thus, agriculture can become a form of mining, and just as non-renewable.

16. For example, improved technology will sustain more people at a given standard of living, or the same number at a higher standard, than before.

17. Ironically, the WCED report advocates growth in the third world partially to produce the economic surpluses needed for sustainable management of the renewable resource base. This situation does not yet pertain to the richest countries of the developed world including Canada and the US.

18. This is not only a common property problem. Clark (1973) has shown that while it may be ecologically disastrous, it is rational and economically more efficient for the owner of a renewable resource to liquidate that resource, if by so doing s/he obtains a higher return from investing the proceeds than by husbanding the resource.

19. Nor does the example account for the erosion, salination, acidification and other problems that are steadily reducing the area and capacity of land in production. Current land management practices are not sustainable.

ON USING ENVIRONMENTAL ASSESSMENT TO PROMOTE FAIR SUSTAINABLE DEVELOPMENT

by Peter Boothroyd

INTRODUCTION

The purpose of this paper is to discuss ways to improve the role environmental assessment plays in supporting fair sustainable development. It begins by defining how the terms "fair sustainable development" and "environmental assessment" are used in this paper.

Fair Sustainable Development

Sustainable development can be defined most generally as purposive social change in which short term benefits do not result in foreclosing long term opportunities.

This paper considers a subset of sustainable development: fair sustainable development. Fair sustainable development (FSD) defined as change which improves immediately the standard of living for the poorest throughout the world without foreclosing their opportunities to maintain their rising standard of living.

It is assumed in this paper that FSD requires the rich to reduce their consumption. This assumption will be rejected by the many who think that we can have infinite win-win development, that the rich and the poor can both consume infinitely more, that the total pie can expand without the pieces ever having to be redistributed.

While it is not within the scope of this paper to argue extensively with that view, two points should be made. The first is that a continuing wide discrepancy in standards of living does not fit my definition of fair. The second point, which is more cogent in a discussion of sustainable development, is that it appears clear the pie cannot continuously be expanded for any reason, whether or not it is to avoid redistribution.[1]

The paper also assumes that while *un*fair sustainable development is conceivable it is so immoral and so practically impossible it should not be considered as an option.[2] It is practically impossible because a world police force would be required to carry out the almost impossible task of forcing the poor to live ecologically soundly and to stay poor so that the rich could consume more than their fair share. It is unlikely that the poor could be repressed from meeting their immediate needs regardless of the cost to the rich and the environment.

Of course, most of the rich including most Canadians, do not agree that what is being called here "unfair sustainable" development is unfair. That is, they do not think they have a moral responsibility to reduce immense standard of living differentials, because they are morally underdeveloped or because they do not see the relationship between their riches and poverty, or because they rationalize that the expanding pie will provide the fix. They also do not agree that unfair sustainable development is practically impossible, in most cases because they have not thought about the difficulties of maintaining world-wide repression. [3]

Examples of actions which lead to FSD are: limiting automobile driving and improving public transit, taxing coffee as a high luxury good and using the proceeds to fund redevelopment of coffee plantations into vegetable plots, giving preference to native food fisheries over commercial harvesters, replacing prairie monoculture with ecologically sound mixed farming, taxing fancy restaurant meals and putting the funds into nutrition supplements to improve the long-run health and productivity of welfare recipients, developing an international program for managing and distributing oil on a need rather than market basis.

Examples of actions which may lead to sustainable development for one society but which are unfair because of their impacts on the rest of the world are: limiting use of poisons at home but permitting their export to poor countries, developing agricultural policies which assume continued reliance of other countries on our grain, enhancing salmon production for the benefit of large commercial interests while severely limiting native food fisheries. [4]

Environmental Assessment

Environmental assessment can be defined as comprising both reactive processes (environmental impact assessment or EIA) and proactive processes (carrying capacity assessment). In this paper only the former is discussed, although in the conclusion its relationship to the latter is noted.

The term EIA in this paper refers to formally prescribed systematic public processes for assessing ecological and social impacts of possible public decisions. By public processes is meant processes which are subject to public scrutiny (e.g., through lists of screening decisions and public availability of initial assessment reports) and public input (e.g., through hearings, panels, consultations).

IMPROVING EIA TO SUPPORT FSD

There are three ways EIA can be improved to support FSD:

1) The application of EIA (what is assessed) can be expanded to policies, regulations and managerial decisions.

2) The process of EIA (how assessment is done) can be made more public, fair and interactive.

3) The questions asked in EIA (why assessment is done) can address more fundamental issues.

Application improvements

EIA's application should be expanded beyond its present project-orientation. If EIA is to help us recognize and deal with the cumulative effects which threaten FSD, it must be also applied to policies, regulations and managerial practices. At present, these are not subjected to EIA in practice, though they should be according to some jurisdictions' EIA guidelines such as Canada's EARP.

The absence of formal EIA from most public planning means that decisions are being made without the benefit of public scrutiny or input. This situation poses three threats to FSD:

1) the short term interests of one group may receive precedence over the long term sustainabilty interests of society as a whole;

2) a powerful richer group's sustainability may be assumed to be more important than that of less powerful groups;

3) FSD-oriented decisions may be based on faulty information or predictions with no provision for the public to play the corrective role it is capable of.

Fisheries management provides a good example of a public management sector where, many believe, decisions are being taken which threaten FSD in all three ways because of the lack of public EIA in the policy making and regulating processes. West coast Indian tribes perceive legalized commercial overharvesting of shellfish, outside commercial interests getting preference over their food needs and therefore over the sustainabilty of their communities, and bureaucratic decision-making based on incomplete ecological knowledge.

Thorough public EIA in fisheries mangement could, if the right questions were asked, minimize the danger of the sustainability criterion being overlooked or downplayed because of the political influence of powerful groups with short-term exploitation interests. Good EIA could even the odds between more powerful interests (e.g., the tourist industry and seiner fleet owners) and less powerful interests (e.g., gillnet fishers and local shellfish harvesters) when trade-off decisions have to be explicitly made between their respective sustainabilty interests. (For example, policies reflecting the notion that small "inefficient" boats should be weeded out would have to be considered in the light of local communities' reactions.) Good EIA could also bring more information and perspectives to bear on planning and so reduce the danger that government decisions regarding stock enhancement, habitat protection, and harvesting procedures, limits and allocations, will be made on the basis of limited or inaccurate information and prediction techniques.

The B.C. Utilities Commission public hearings on the proposed Peace River Site C dam provide a good example of the uses of EIA. The sustainability of B.C.'s long-term productivity was identified as a concern by public interest groups and local intervenors; the issue of the sustainability of the Peace River valley as a farming community versus the sustainability of B.C.'s hydro export role was raised in public consciousness; and the hydro demand forecasts and agriculture-potential analyses of the proponent, B.C. Hydro, were effectively challenged. [5]

The environmental impacts of the proposed Peace River Dam were carefully assessed through

public review in large part because the dam is a discrete project. Unfortunately, energy sector policies, regulations and day-to-day managerial decisions are not now subject to public scrutiny through EIA even though the accumulation of their impacts may affect much more than any one project our chances of achieving FSD.

In this light, there should be EIA of: energy policies; regulations and managerial decisions related to urban form (and therefore transportation demands for energy); site design (and therefore space-heating demands and supply possibilities for energy); building codes; transportation mode support; industrial fuel choices and efficiencies (related to subsidies); fuel pricing; energy conversion pollution and risks.

There are many other sectors besides *fishing* and *energy* where EIA should be applied to policies, regulations and managerial practices. Here are some of what may be the most important:

• *agriculture* policies, regulations and managerial decisions on land clearing, subsidies, fertilizer, pesticide, herbicide, fallowing, irrigating and grazing which affect the sustainability of our prairie farms;

• *forestry* policies, regulations and managerial decisions related to harvesting practices, fish and wildlife habitat protection, replanting requirements and silviculture;

• *waste management* policies, regulations and managerial decisions related to recycling, pollution, land use.

• *land use* policies, regulations and managerial decisions related to appropriate use of fertile land (not just preservation), urban density, settlement locations, habitat preservation and species conservation,

• *health care* policies, regulations and managerial decisions on preventive medicine, disease control, drug control (including tobacco, caffeine, nicotine), physical fitness.

In all these cases the ecological and social impacts of possible political, regulatory and managerial decisions should be formally, systematically and publicly assessed to determine whether they threaten FSD and whether they do as much as they could to enhance that sustainabilty. In addition to working against bad decisions, each EIA would contribute to raising public consciousness about FSD goals and means. This is a vital contribution because FSD cannot be achieved without heightened public consciousness.

Of course thousands of public decisions are made daily in this country and not all can be subject to as much attention as the Site C dam proposal. We have to determine which kinds of decisions deserve most attention, and which assessments will give us the most leverage in promoting sustainable development.

It might appear that assessement of proposed and existing policies would appear to give us most leverage, but in most cases policy is implicit and therefore not amenable to formal review. In many of those cases where policy is explicit, it does not direct practice. (Consider Canada's policy on EARP for example which 14 years after its introduction still does not guide departmental practices to any significant degree.)[6] The assessment of ineffectual policy is not an efficient use of

time. Therefore, the assessment of policy will only occasionally be an effective and efficient use of human resources.

What may offer high leverage more often is the assessment of *regulations* and those *managerial decisions* which directly affect public consumption and production practices (e.g., decisions on fishing closures, grazing rights, solar heating subsidies, garbage collection limitations, subdivison densities, cigarette machine placements). Not all of these possible decisions can be nor need be assessed by all publics. What is needed is a process for getting the right people involved in effectively assessing any particular decision.

This leads us to the following discussion on process.

Process improvements

The challenge for EIAers is to design formally prescribed processes whereby the most knowledgeable, affected and concerned publics are given notice of impending decisions of interest to them, are offered meaningful opportunity to comment, are in some cases given assistance to comment, are not only listened to by planners and decision-makers but are also replied to, are enabled to interact honestly and creatively with other interested parties, and are given media attention.

Such public, fair and interactive EIA processes will promote FSD because they will widen the debate on any given issue. FSD will be promoted by wider debates because they will improve the quality of immediate decisions by ensuring as much information as possible, from as many people as have information to contribute, is brought to bear on decisions involving trade-offs between short term and long term interests, or between powerful rich interests and weak poor interests. The systems we live in, and whose sustainability we affect by our decisions, are so complex that we cannot afford to overlook any relevant knowledge. Public, fair and interactive EIA ensures that we bring all this knowledge to bear, including that from such usually unrespected sources as local people committed to their area, e.g., native fishermen.

Wider debates will also raise public consciousness by helping people involved in or following them to see the connections between their short term and long term interests, and between their own interests and those of others. Increased public knowledge of the consequences of general development directions is essential for our society to agree to make the current sacrifices necessary to achieve sustainable development.

What are some of the process improvements which will particularly help us achieve FSD? At the most general level, there are four possibilities: increase public knowledge about decision-making (e.g., through meaningful screening lists); give financial assistance to weaker interests to allow them to undertake and present to EIA forums their own FSD-oriented assessments; increase direct interaction among interests in EIA processes so that they are educating each other as well as blue-ribbon panels; require explanations to the public of decisions involving tradeoffs between FSD and short-term specialized interests.

All of these would be very useful, but perhaps the most leverage would come from assisting weaker interests to provide input to decision-makers through EIA processes. These weaker interests would be locally affected communities but they could also be public interest groups. There are many environmental groups and international development organizations who would

make valuable contributions to debates on sustainability and fairness if they were assisted to identify the implications of plans prepared by people with only short-term local objectives in mind.

This assumes of course that EIA is extended beyond its current project orientation to playing a role in the planning of regulations, managerial decisions, and policies.

To some this may suggest a nightmare of public planning processes which slow decision-making to an unacceptable pace. But one person's nightmare may be another's dream. Slowing decision-making might reduce the rate at which we are precluding FSD.

In the long-run, though, very slow decision-making would prevent us from taking action to move toward FSD— the staus quo will not take us there.

What we need then is *efficient*, as well as extensive, public, fair and interactive EIA.

The very challenging task of developing EIA procedures and processes which have all these qualities is one to which agencies such as CEARC might well devote their effort.

Content improvements

If EIA is to make a play a significant role in promoting FSD, it must not only be applied to the right kinds of government decisions and follow a good process. It must also ask the right questions.

To date, EIA has primarily been concerned with discrete impacts on local systems. Ostensibly its purpose has included ensuring that decisions are taken with an understanding of irreversible consequences for the natural environment, but in fact EIA has not considered cumulative impacts on local or world-wide systems. In part this is because of the narrow view of EIA practitioners—the assessors and their employers.

Environmental impact assessments have studied local pollution and habitat stress but not world wide cumulative impacts of greenhouse effects, acid rain, resource depletion, toxin accumulation, and increased risks of disaster. Airport impact assessments have not addressed the consequences of increased oil usage promoted by expanding air transportation. Petroleum development impact assessments have not considered the consequences for lowered prices (therefore increased usage and therefore more rapid reserve depletion) of adding supply at a time of high world oil productibility. Social impact assessments of northern projects have intensively studied job creation but not the boom-bust risks for marginal workers of construction phasing, project cancellation, or resource depletion. They have not looked at projects designed to bring northern resources to southern consumers in terms of the impacts of these projects on the sustainability of development in poor northern communities.

EIA has not had a global or long term perspective because our culture does not. We hardly think about the relationships between most Canadians' overall wealth now and the poverty of some other Canadians today, of many next-generation Canadians, and of most non-Canadians now and in the future. We do not think about the relationship in terms of the direct impacts of our consumption on the availability of scarce resources for others, let alone in terms of the potential

feedback of this consumption on all our standards of living because of the megaproblems (nuclear war, massive pollution, ecosystem collapse) which will be caused by growing world poverty.

This poses a chicken-and-egg problem: EIA practitioners do not deal with the sustainability issue because our culture does not, but our culture does not because we are so rarely called on to consider the issue in concrete terms at decision-making time. Nevertheless, at the cultural end there are a few people trying to heighten our consciousness. Perhaps a few people working at the EIA end could help to set up a dialectic of positive feedback loops whereby cultural awareness and thoughtful EIA content reinforce each other.

The high-leverage approach to ensuring the right questions are asked in EIA is to insert a clause in all EIA-guiding procedures requiring them to address FSD.

We must remember, however, that a factor preventing EIA from considering impacts on FSD which is perhaps equal in importance to the restricted spatial and temporal view of EIA practitioners, is that EIA cannot effectively consider cumulative impacts so long as it is restricted to assessing the impacts of projects and is kept away from policies, regulations and managerial decisions. Only an immense project is likely to be seen as causing major unmitigable environmental damage or resource depletion. Most danger to FSD will quite correctly be seen as coming from the cumulative effects of innumerable individual actions which are promoted and permitted by certain policies, regulations and managerial decisions.

An example of such resource depleting and polluting actions is the daily automobile driving by millions of Canadians. Questions about the sustainability of our oil-consumption way of life and its impact on the consumption prospects for the rest of the world can best be answered by assessing transportation policies and regulations of all government levels and by assessing day-to-day decisions of transit officials, roadway engineers and town planners—not by assessing the occasional major freeway proposal.

Our discussion of EIA content is thus brought full circle back to the issue of EIA applications.

CONCLUSION

To promote fair sustainable development EIA must be a public, fair, and interactive process through which are assessed the cumulative local and global impacts of policies, regulations and managerial decisions.

That is, EIA can help promote FSD if it is applied to the right decisions, is properly structured, and asks the right questions.

We have seen how these three desiderata for EIA depend on one another. By broadening the application of EIA we cannot improve its utility for promoting FSD if the process is closed and the wrong questions asked. By opening the process we cannot improve EIA's usefulness from an FSD point of view if this process is restricted to looking at local pollution and short term local social effects. By asking the right questions of hundreds of projects we will never achieve as much as asking the right questions of the policy which induces these projects.

While EIA can help to promote FSD, its contribution will always be inferior to that of proactive planning, including proactive environmental assessment. To determine if a predicted impact is an acceptable cost or not, a decision-maker must know what goals s/he is pursuing. Goals are identified through proactive planning. Proactive planning can answer the following crucial questions which EIA (by definition reactive even though it can be a step in a proactive process) cannot:

How high a standard of living can we sustain?

How should wealth be distributed generationally and geographically?

How much risk are we willing to take?

Fair sustainable development will only occur when we develop the institutions to implement the answers to these questions at all system levels - most importantly but most difficultly, at the world system level. In the meantime, EIA can help create the knowledge, awareness and understanding which is necessary to develop these institutions.

NOTES

1. Oil is but one example of a resource whose production levels cannot be continuously increased as an alternative to redistributing supplies within present levels. North Americans burn 24 barrels of oil per year per capita while the rest of the world consumes 3. World oil production would have to be quadrupled, which would be environmentally problematic even if it were physically possible, in order to enable the rest of the world just to drive cars as much as we do. If there are technological fixes to this problem of disparity they remain distant. In the meantime, if our world economy is to be fair and sustainable, the rich must quickly and significantly curtail their consumption of rapidly dwindling oil.

2. Sustainability and fairness are conceptually independent dimensions. Unfair unsustainable development —the worst case— is what we have now. Fair unsustainable development is logically impossible if we define fair as including inter-generational fairness.

3. Garrett Hardin is a rare example of a person who has thought about these matters and approaches coming out in favour of unfair sustainable development because he sees it as a lesser evil than our current unfair unsustainable development (his lifeboat ethics concept) and the only hope despite the practical difficulties (his world government solution to the "Tragedy of the commons").

4. There are actions oriented to sustainable development which, when considered generally, appear to be neither necessarily fair nor unfair: e.g., substituting solar heating for non-renewable fuels. The way in which such an apparently neutral action is taken, however, will tilt it one way or the other. For instance, solar heating retrofitting policies may favour large or small homeowners.

5. M. Davidson and P. Boothroyd, "The Site C Social Impact Assessment: Effectiveness of Public Hearings," prepared for study on "Review and Analysis of Institutional Arrangements under which Social Impact Assessment Studies are Conducted in Canada," through L. J. D'Amore and Associates Ltd. under contract to Canadian Environmental Assessment and Resarch Council, 1986.

6. W. Rees and P. Boothroyd in association with The Rawson Academy of Aquatic Science. "A Background Paper on EARP Reform: Activities" and "A Background Paper on EARP Reform: Process and Structure," prepared for Canadian Environmental Assessment and Research Council, November 1987.